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Acceleration of the Universe with Variable Gravitational Mass

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Old and painful problem of Einstein gravitational theory: **Why gravitational energy is not a tensor?**

A.Einstein and A.Eddington find the solution in framework of new (>1919) interpretation of classic Einstein equations (versus old interpretation by 1916). See:

1. *Einstein, A. (1953), The Meaning of Relativity, 4th Edition, Princeton University Press, Princeton. (p.133, Appendix II, 4th Edition only!)*
2. *Eddington, A.C. (1975), The Mathematical Theory of Relativity. Chelsea Publishing Company, New York, N.Y.*

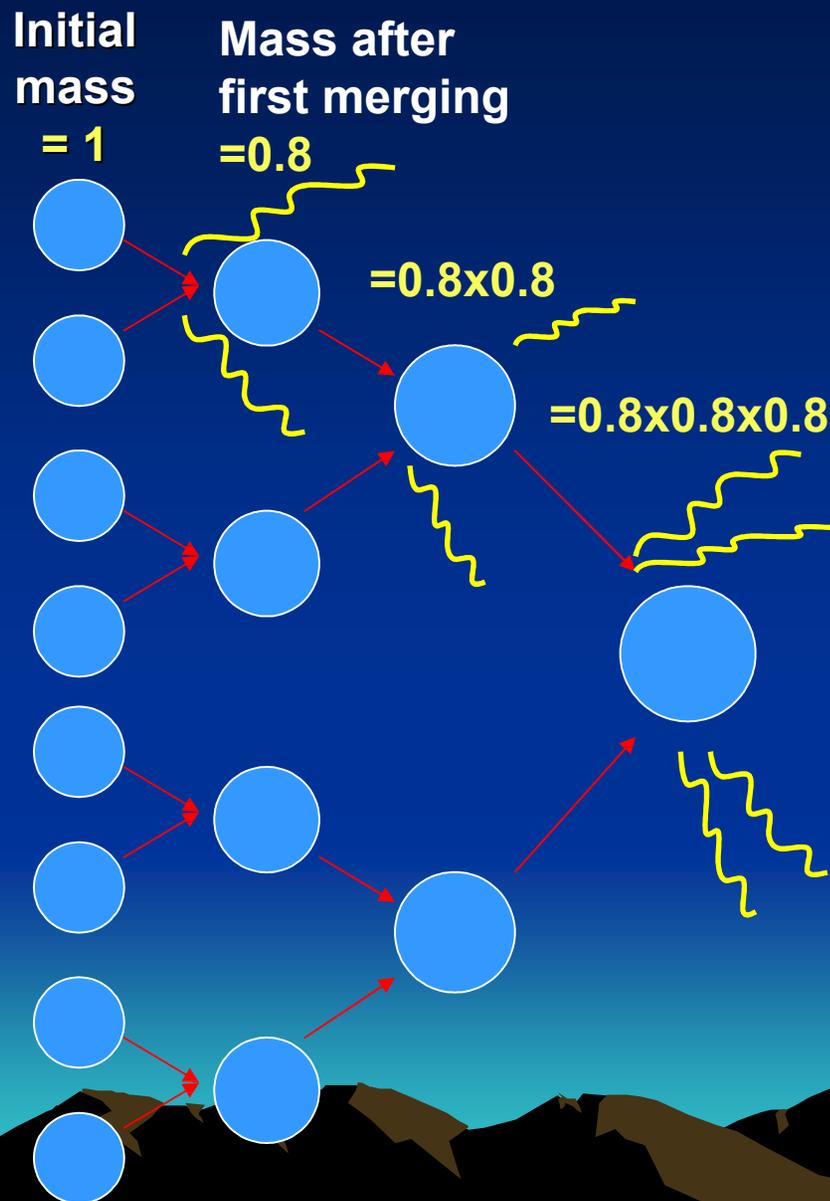
**Important by-product of the Einstein-Eddington solution is the conclusion that gravitation waves can not be a source of stationary gravitational field (as laser beams don't generate stationary electric fields).
By other words, source of gravitational fields is a matter only.**

Who cares about gravitational mass of gravitational waves?



Gravitation radiation from merging black holes

Let us consider the Universe from 2^{73} (or 10^{22}) black holes.



After a sequence of 73 mergers mass of matter in the Universe will $0.8^{73} = 0.000008\%$

Other 99.999992% (or $1.0 - 0.8^{73}$) of mass of the Universe was transformed in the gravitational radiation

Ergo the Universe has a variable total gravitational mass that close to zero on final stage of gravitational collapse.

100% of matter of the collapsing Universe from usual matter (stars etc.) must be transformed into the gravitation radiation.

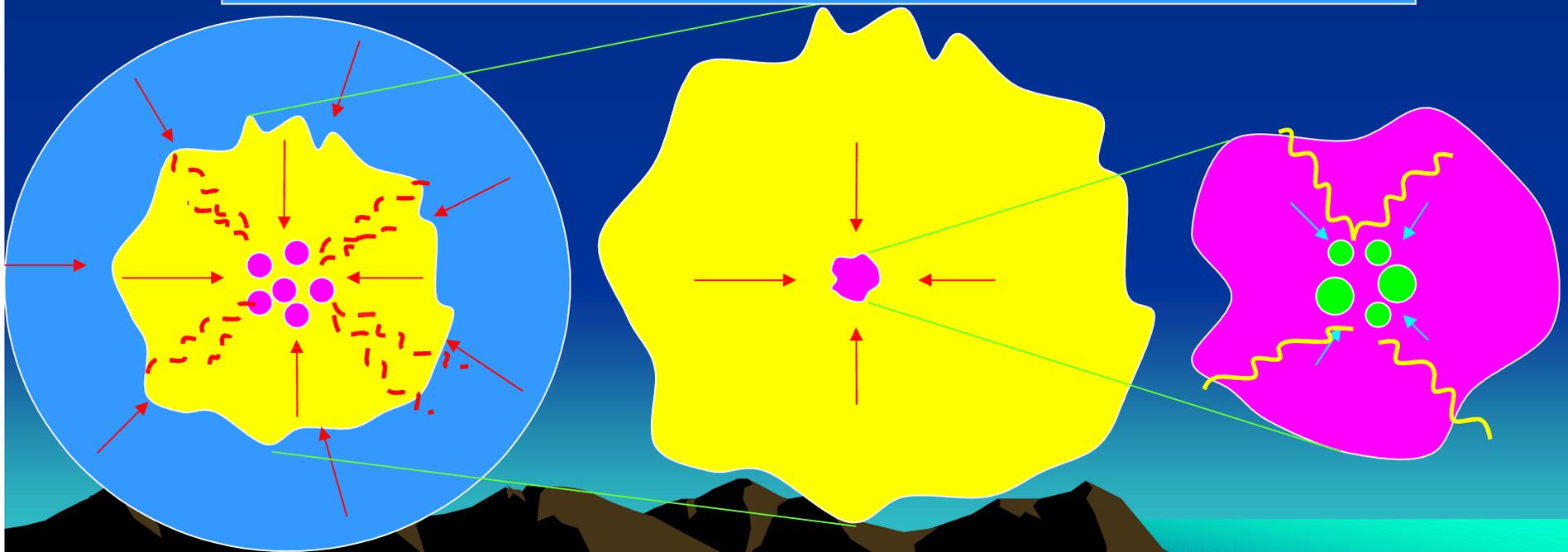
The growth of fluctuations in collapsing Universe: E.M.Lifshitz, I.M.Khalatnikov, UFN, 80, 391, 1963; origin of black holes from fluctuations during collapse: T.Banks, W.Fishler, Black Crunch, hep-th/0212113, 12 Dec. 2002

We can not stop a gravitational collapse

= We can not stop a gravitational instability (or growth of fluctuations)

= We can not stop a generation of gravitational waves

= The Universe near singularity will be a cloud of gravitational radiation with gravitational mass ~ 0 .



Gravitational force for variable gravitational mass.

Newton force : $F = - \frac{\partial \phi}{\partial r} = - \frac{\partial}{\partial r} \left(- \frac{Gm}{r} \right) \quad (1) = \text{for } m=\text{const} = - \frac{Gm}{r^2}$

Let us consider :

-variable gravitational mass: $m = e^{-t/T} \quad (2)$

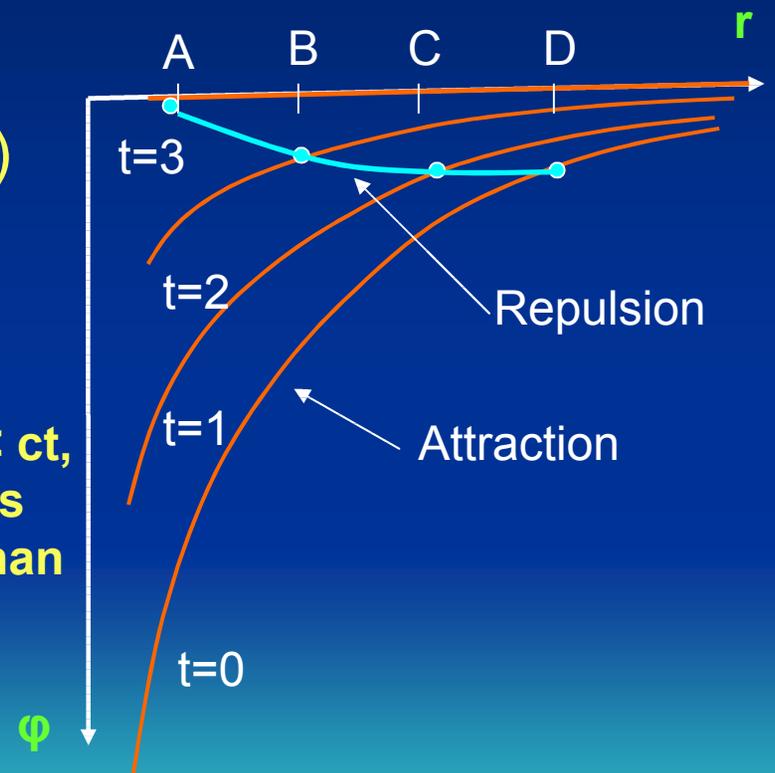
- and finite speed of propagation of gravity: $t = t - r/c \quad (3)$

Gravity force for variable mass from (1)-(3) is *):

$$F = - \frac{Gm}{r^2} + \frac{Gm}{rcT} \quad (4)$$

Attraction Repulsion

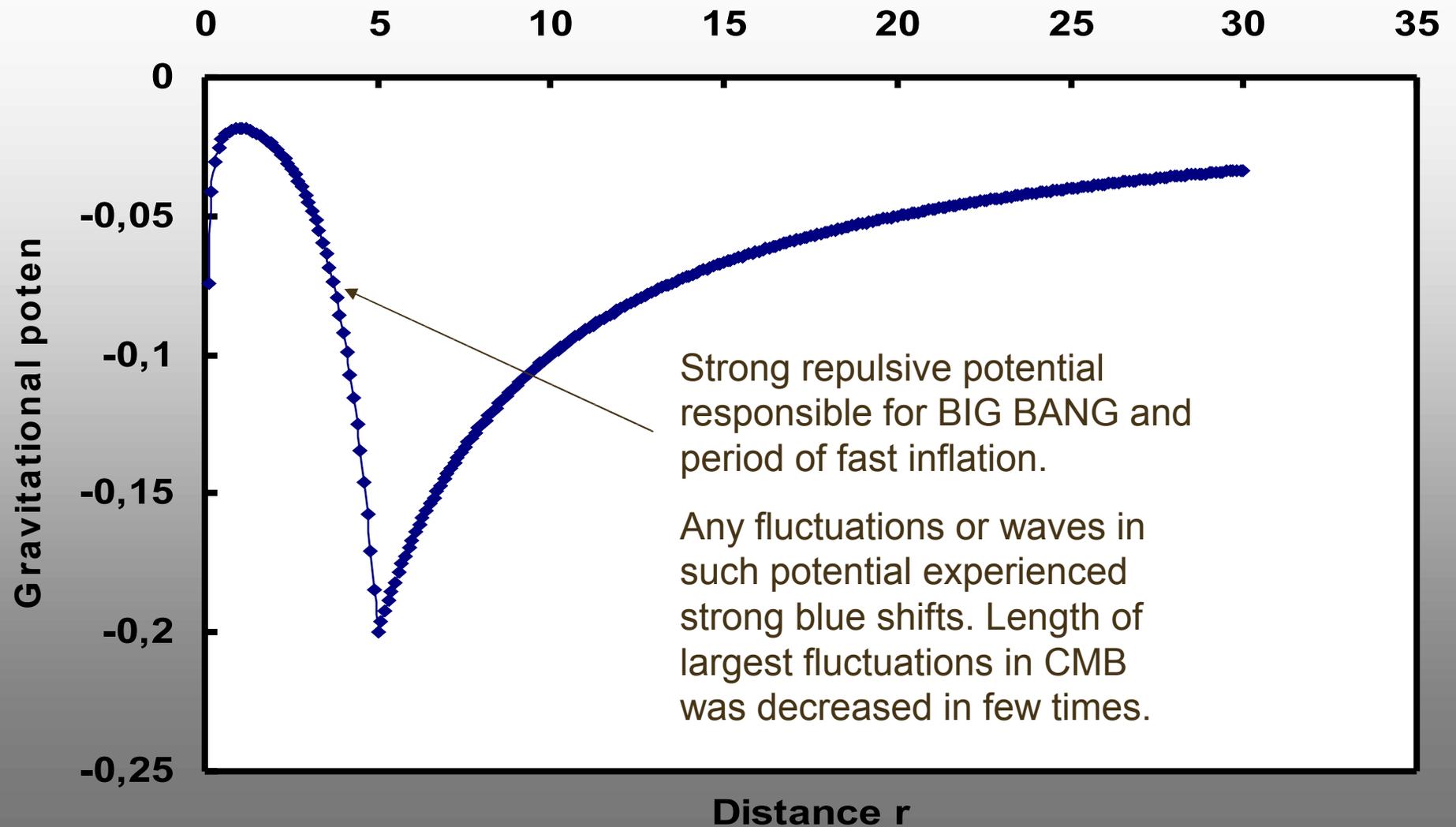
for $cT < r < ct$,
repulsion is
stronger than
attraction



*) Gorkavyi, N.N. Origin and Acceleration of the Universe without Singularities and Dark Energy. Bulletin of the American Astronomical Society, 2003, 35, #3.

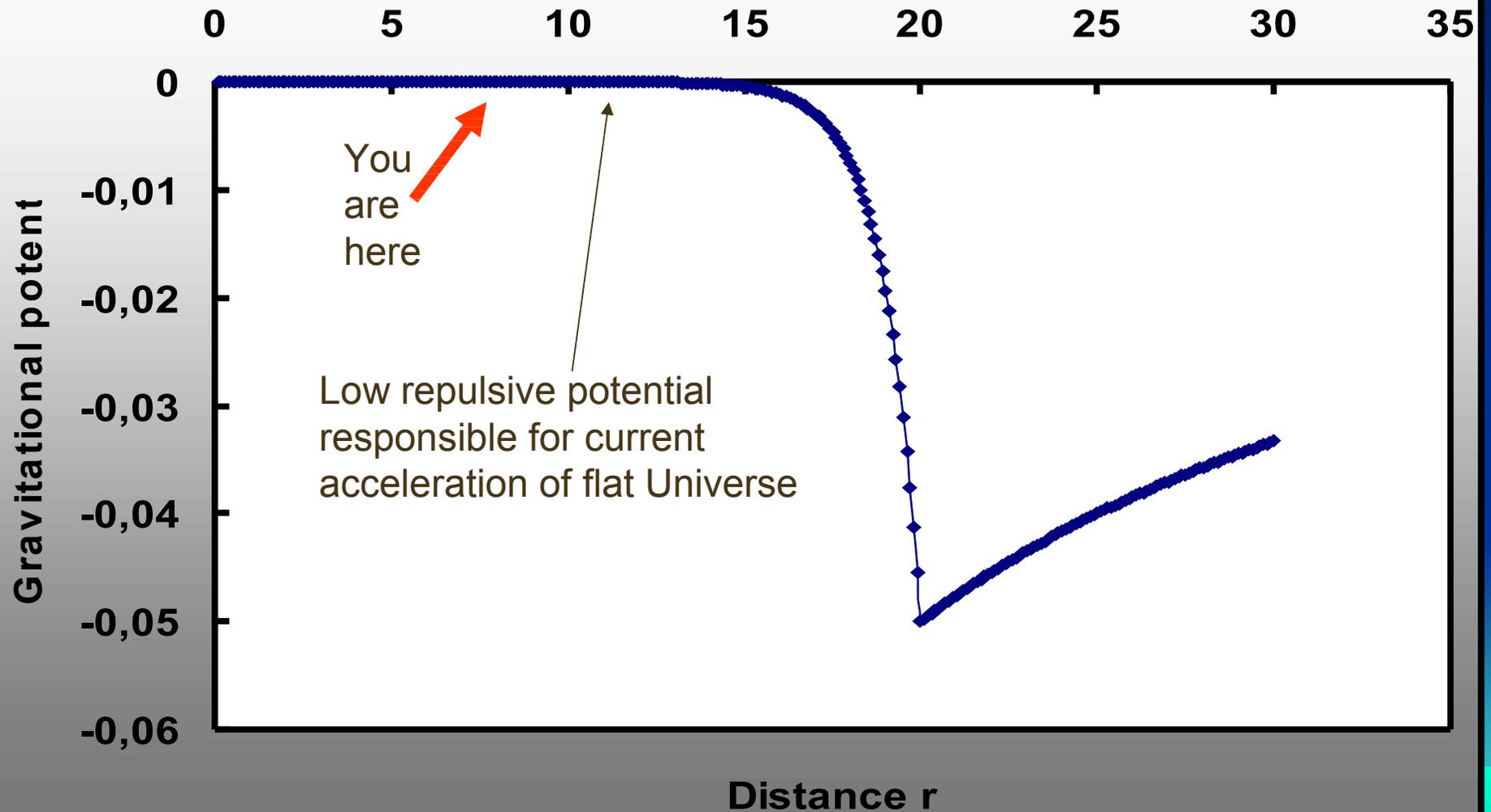
Gravitational Potential for the Universe with variable gravitational mass.

$t = 5T$



Gravitational Potential for the Universe with variable gravitational mass.

$t = 20T$



Conclusion

Idea of fast decreasing gravitational mass of the Universe during gravitational collapse (as result of generation of gravitational radiation) can help to solve next problems:

1. Elimination of singularities (as result of zeroing gravitational mass);
2. Origin of strong repulsive force for the Big Bang (and period fast inflation);
3. Nature of repulsive force for current acceleration of Universe;
4. Cause of low quadrupole in fluctuations in CMB (as result blue-shift of fluctuations on the strong repulsive potential after the Big Bang).
5. “Kerrigan problem” (attraction and repulsion are two sides of gravity and this is good base for solution of the coincidence problems)

The idea is inside the Einstein relativistic theory but don't contradict to theorems by Penrose-Hawking about singularities (these theorems are correct for the Universe with constant mass).

The idea keeps best parts of Big Bang theory (fireball, origin of elements) and inflation theory (period of fast inflation, flat Universe) without any unknown physical fields, new dimensions etc.



P.S. About c^5/G

Huge constant c^5/G in equations for gravitational radiation is physically important. Misner, Thorne, Wheeler (Gravitation, 1973) consider this constant as maximal from possible value for radiation of a single system. But inside of black hole or during Big Crunch it is not true. Let consider variability of radius of a black hole as function of variability mass:

$$R=2GM/c^2 \Rightarrow dR/dt = 2G/c^2 dM/dt = 2G/c^4 dE/dt$$

If gravitational radiation is $2dE/dt > c^5/G$ then velocity of decreasing radius of black hole is faster than speed of light: $dR/dt > c$

When gravitational radiation during collapse is larger than the constant $c^5/2G$, then radius of black hole must decrease faster than a speed of any falling observers. This is condition of opening black holes. For any outer observers black holes are black. For any falling observers black holes are exploded.

*We well know the one such explosion: **Big Bang.***

